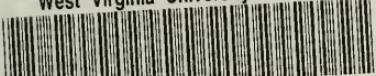


West Virginia University Libraries



3 0802 100762109 7

West Virginia University Agricultural Experiment Station

MORGANTOWN

DEPARTMENT OF HORTICULTURE

PRUNING FRUIT TREES



Before and After Severe Pruning to Rejuvenate a Neglected Tree.

BY

W. H. Alderman and E. C. Auchter

The Bulletins and Reports of this Station will be mailed free to any citizen of West Virginia upon written application. Address Director of the West Virginia Agricultural Experiment Station, Morgantown, W. Va.

THE STATE OF WEST VIRGINIA

Educational Institutions

THE STATE BOARD OF CONTROL

JAMES S. LAKIN, President.....	Charleston, W. Va.
A. BLISS McCRUM.....	Charleston, W. Va.
J. M. WILLIAMSON.....	Charleston, W. Va.

The State Board of Control has the direction of the financial and business affairs of the state educational institutions.

THE STATE BOARD OF REGENTS

M. P. SHAWKEY, President.....	Charleston, W. Va.
State Superintendent of Schools	
GEORGE S. LAIDLEY.....	Charleston, W. Va.
NOAH G. KEIM.....	Elkins, W. Va.
EARL W. OGLEBAY.....	Wheeling, W. Va.
JOSEPH M. MURPHY.....	Parkersburg, W. Va.

The State Board of Regents has charge of all matters of a purely scholastic nature concerning the state educational institutions.

West Virginia University

FRANK BUTLER TROTTER, LL.D.....	President
---------------------------------	-----------

AGRICULTURAL EXPERIMENT STATION STAFF

JOHN LEE COULTER, A.M., PH.D.....	Director
BERT H. HITE, M.S.....	Vice-Director and Chemist
FRANK B. KUNST, A.B.....	Assistant Chemist
CHARLES E. WEAKLEY, JR.....	Assistant Chemist
J. H. BERGHIUS-KRAK, B.Sc.....	Assistant Chemist
GEORGE W. BURKE, B.S.....	Assistant Chemist
W. E. RUMSEY, B.S. Agr.....	State Entomologist
N. J. GIDDINGS, M.S.....	Plant Pathologist
ANTHONY BERG, B.S.....	Assistant Plant Pathologist
†L. I. KNIGHT, PH.D.....	Plant Physiologist
HORACE ATWOOD, M.S. Agr.....	Poultryman
E. L. ANDREWS, B.S. Agr.....	Assistant in Poultry Husbandry
F. W. STEMPLE, M.S.....	Agronomist
T. C. McILVAINE, M.S. Agr.....	Assistant Agronomist
HENRY DORSEY, B.S. Agr., M.S. Agr.....	Assistant Agronomist
I. S. COOK, JR., B.S. Agr.....	Consulting Agronomist
W. H. ALDERMAN, B.S. Agr.....	Horticulturist
A. L. DACY, B.Sc.....	Associate Horticulturist
E. C. AUCHTER, B.S. Agr.....	Assistant Horticulturist
L. F. SUTTON, B.S., B.S. Agr.....	Assistant Horticulturist
H. L. CRANE, B.S. Agr.....	Assistant Horticulturist
ROLAND H. PATCH, M.S.....	Assistant Horticulturist
L. M. PEARS, M.S.....	Research Entomologist
E. W. SHEETS, B.S. Agr., M.S.....	Animal Industry
J. J. YOKE, B.S. Agr.....	Assistant in Animal Industry
R. H. TUCKWILLER, B.S. Agr.....	Assistant in Animal Industry
W. A. RHEA, M.S. Agr.....	Assistant in Animal Industry
A. J. SWIFT, M.S. Agr.....	Assistant in Animal Industry
C. A. LUEDER, D.V.M.....	Veterinary Science
ROBERT M. SALTER, M.Sc.....	Soil Investigations
C. F. WELLS, A.B.....	Assistant Soil Chemist
FIRMAN E. BEAR, M.Sc.....	Consulting Soil Chemist
*A. J. DADISMAN, M.S. Agr.....	Farm Management
*C. F. SARLE, B.S.....	Assistant in Farm Management
*C. H. SCHERFFIUS.....	In Charge of Tobacco Experiments
A. B. BROOKS, B.S. Agr.....	Forester
C. E. STOCKDALE, B.S. Agr.....	Agricultural Editor
W. J. WHITE.....	Bookkeeper

[†]In co-operation with the University of Chicago.

^{*}In co-operation with the U. S. Department of Agriculture.

PRUNING FRUIT TREES

By W. H. ALDERMAN and E. C. AUCHTER.

INTRODUCTION.

Scientists know comparatively little about the real effects of pruning upon the life processes of a tree. Those who have made studies of a few of the problems attendant upon pruning do not entirely agree in their recommendations. Although professional horticulturists, aided by nearly all the sciences related to horticulture such as chemistry, botany, physics, and plant physiology, are gradually uncovering new truths, their progress is necessarily slow. In the meantime trees must be pruned. The purpose of this bulletin is to furnish to the grower simple and practical directions for pruning based upon the most recent information available. Time may prove some of these recommendations to be wrong, but they seem to be the best that may be given in the light of present-day knowledge.

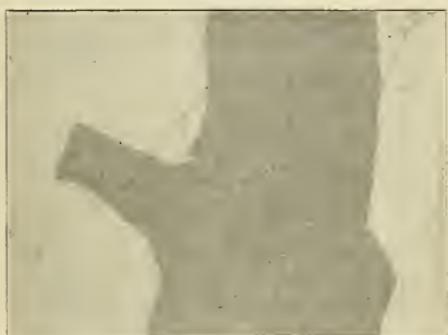
Vegetative and Fruitage Periods. There are two distinct periods in the life history of a tree. The first is the vegetative period in which the tree devotes all its energy to wood growth, and the second is the period of fruitage during which a large proportion of its energy is directed to fruit production. The pruning during the vegetative stage is almost purely mechanical in its effect,—the building of a tree having a framework that will combine, to best advantage, great strength and bearing capacity with a form well adapted to all orchard operations. This mechanical phase of pruning, sometimes termed "training," should be confined to the first three, four, or five years of the tree's life. Subsequent pruning is for the purpose of, first, increasing the fruit production; second, maintaining a suitable tree environment such that the fruits may attain maximum development in color, size, and quality; and third, preventing a congestion of small branches which would render the operations of spraying, thinning, or harvesting unduly difficult. Detailed and specific directions for pruning the common tree fruits will be given.

Correct Way to Remove a Limb. Before any pruning is done, it is necessary that the operator understand the right

and wrong way of making a cut and of removing a limb. The wound made by the removal of a branch will heal most readily if the cut is made close to the main stem and parallel with the stem. When the pruning tools get dull and one's arm begins to ache, it is a temptation to make the cut out where the limb is smaller and easier to remove. This cut always results in a slow-healing wound at best and usually in a stub which dies, decays, and finally drops off leaving a hole that eventually carries the rot into the heartwood of the tree. Right and wrong methods are better illustrated than described, and the reader is advised to make a careful study of Figures 1 to 6 inclusive. If a large limb of an old tree is

Fig. 1.—Cut shown above will heal readily. Stub of lower cut will decay into heartwood.

to be removed, always first saw in a short distance on the under side of the limb before cutting it off so as to prevent splitting down when the limb is nearly sawed through.



PRUNING THE APPLE.*

Height of Head. In former years the head, or main branches of an apple tree, was started at from four to six feet above the ground. More recently, however, the tendency has been to start the branches nearer the ground. The advantages claimed for the lower head are:

1. Elimination of several feet of worthless trunk.
2. Earlier bearing.
3. Greater resistance to effects of wind.
4. Easier pruning, spraying, thinning, and harvesting.

*Results of recent experiments in pruning apple trees are more fully discussed by the authors of the bulletin in Bulletin 158 (Technical), copy of which may be secured upon application to the West Virginia Experiment Station, Morgantown.

To offset these points, the high headed tree makes orchard cultivation somewhat easier and, in places where air drainage is poor, possibly allows a little better circulation of air beneath the branches. The latter point is of little or no consequence in a region of hilly or rolling land, and the first is practically overcome by the use of special orchard harrows and cultivators designed for use under low branches.

We may assume that, for West Virginia conditions, low heads are desirable. Just how low apple trees may be headed is a source of frequent argument. The great majority of growers prefer to start the head from 20 to 30 inches from the ground. Little can be gained by starting the head lower than this and the difficulty in cultivating close to the tree and in searching for borers is greatly increased. If one buys two-year-old trees the heads will already have been established by the nurseryman at a height of from 30 to 36 inches. As a rule, the larger the tree, the higher the head. If it is desired to start the head lower than the latter height, the one-year-old tree must be purchased. This tree is usually unbranched and may be cut back to any desired height. The side branches, which determine the height of head, will start just below the cut, so that this should be made at a point approximately



Fig. 2.—Some of the results of leaving stubs.

four to six inches above the height at which the lowest branch is desired. Thus, if a 20-inch head is to be secured, the tree should be cut back to 24 or 26 inches.

Form of Tree. Apple trees are ordinarily grown in one of three general forms: central leader, open head, or "natural form." The central leader tree is one having a main central stem or axis from which laterals spring in two or more well defined whorls (Fig. 7) or sometimes at irregular intervals along the stem. The open head tree is one having no central



Fig. 3.—(A) Limb cut close and nearly healed over. (B) Limb cut too long and healing slowly. (C) Bark and wood torn by careless pruning. This tearing could have been avoided by first making a shallow cut beneath the limb.

stem, the trunk dividing at the head into three or more large branches which carry the weight of the entire tree (Fig. 8). The natural form is usually no form at all. It is ordinarily made up of a cluster of branches springing from one point and forming a round top (Fig. 9). Since the one who prunes is not working toward any standard or ideal, he almost invariably leaves too many scaffold branches which crowd and have to be thinned out in later years. This latter system is not recommended and will not be further described.

Before any pruning is done, the orchardist should determine whether he will build a central leader or open head type of tree. The former has some advantages which should be considered. It is, first of all, a strong tree. The lateral branches are smaller than the main stem and do not form crotches which are as liable to split apart as those between limbs of nearly equal size such as may be found in an open head tree. The dead weight of a mature tree carrying 20 to 30 bushels of fruit places a heavy strain on all tree crotches, the length of the branch giving the weight of the fruit and foliage a powerful leverage. Under stress of storm this strain is developed to an enormous extent. Engineers erect buildings and bridges to carry a maximum load and still have a good margin of safety. In building our trees, we must prepare not only for maximum crops but also for additional strains caused by storms and still maintain a margin of safety. In the central leader tree, two whorls or

Fig. 4.—Limb not cut close and stub now dying.

scaffolds are used and the weight of the tree is distributed among six or eight branches arranged along two or three feet of a strong central stem instead of being borne on three or four branches arising at approximately the same point, as is the case with the open head tree. It seems clear that this distribution of weight among double the number of limbs reduces by at least one-half the strain upon any one of them. On the wind-swept hills of West Virginia the strength of the central leader tree is a convincing argument in its favor. In addition to strength, this type of

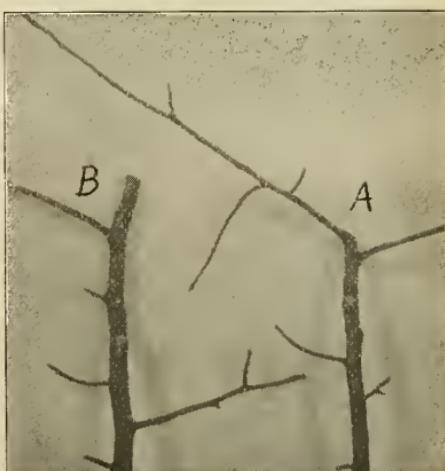


Fig. 5.—(A) Limb properly cut back to a lateral branch. (B) Limb improperly cut back leaving stub.



tree is generally credited with producing a greater bearing surface than an open head tree, since the space in the center is more completely occupied. In some regions it is said that fruit will not color as well on a central leader tree as on an open head one. If the branches are properly thinned, little trouble will be experienced in securing color, particularly in this state where high color is the rule.

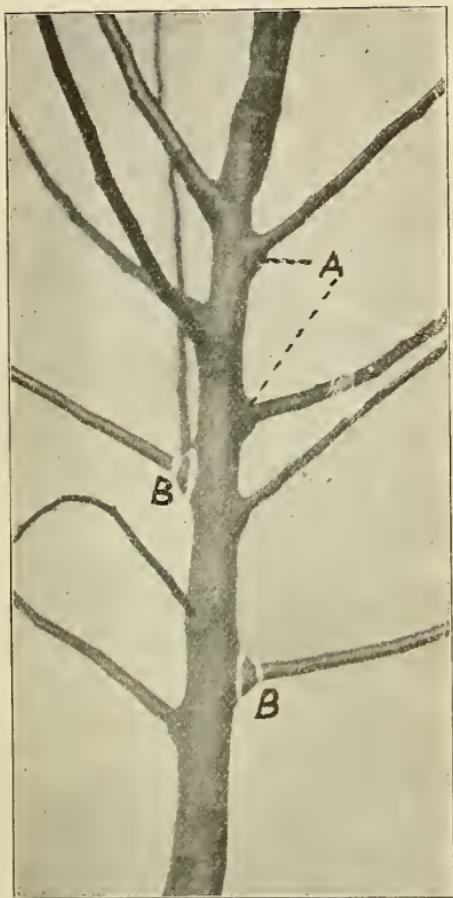


Fig. 6.—(A) Collars formed on limbs at junction with main stem. (B) Cut should be made close to main stem through the collar as shown by inner line. If made on outer line, wound will heal slowly and leave a rough knot for several years.

be cut back, and any injured or partly broken root should be cut off just back of the injury.

After the tree is planted the pruning of the top should be performed. Before the tree is planted one can not tell at what height to cut back the trunk to form the

While the authors strongly recommend the central leader type of tree, they must in all fairness admit that an experienced man may build an open head tree which will be strong enough for all practical purposes. It will be far safer, however, for the inexperienced grower to adopt the central leader type, as this naturally makes a stronger tree.

Pruning at Planting. When the tree is being prepared for planting, the roots should receive the first attention. During the process of removal from the nursery many roots were necessarily cut off, broken, or injured. All broken or frayed ends should be cut away, thus leaving a smooth surface over which a callus may form. Usually a slanting cut is made on the under side of the root so that the cut surface will rest firmly against the soil in the bottom of the hole. Long, weak, straggly roots should

head, because it is difficult to plant each tree at exactly the same depth and a tree cut back and then planted too deep would be headed too low. If a 20-inch head is desired, the average sized man will find he has a very accurate measure if he cuts the tree off at a distance of about three or four inches above his knee. If a two-year-old tree in which the head is already formed is used, it will be found much easier to select the proper limb arrangement and do the pruning after plant-

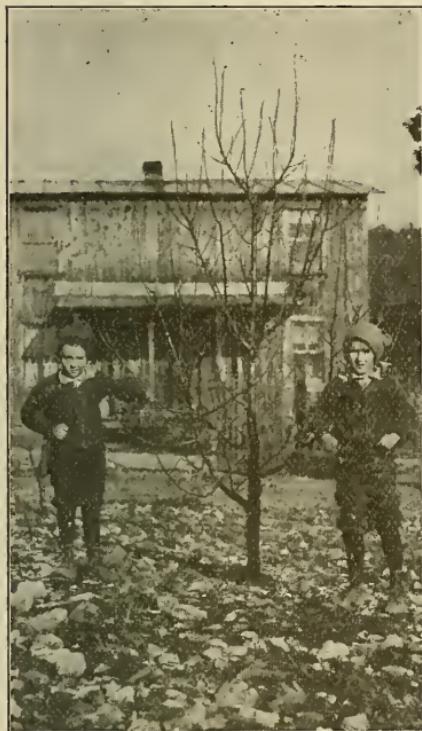


Fig. 7.—Showing central leader trees with three scaffolds. Note the low heads.

ing than before. Besides, if the limbs are thinned to the proper number before planting, some may be broken during the planting operation and a one-sided tree will result.

How much of the top should be removed when the tree is planted and how many limbs should be left? If a yearling tree is planted, all the top should be cut away, leaving a straight trunk reaching from four to six inches higher than the lowest limb desired. The writers prefer to leave the trunk from 24 to 26 inches high. If a two-year-old tree is planted, remove all but three or four side branches which are well distributed about the trunk. If these branches are strong

and sturdy, they may be headed back to twelve or sixteen inches in length; but if they are weak, they should be cut back to short stubs three to six inches long. The central leader should be headed back until it is slightly longer than the side branches (Fig. 10).

In the following directions for pruning after the first second, and third years' growth, it is assumed that a yearling was planted and cut back to a straight switch. Since the central leader type of tree is recommended, the directions given apply to this form and special attention is called to such changes as are required to form the open head tree.

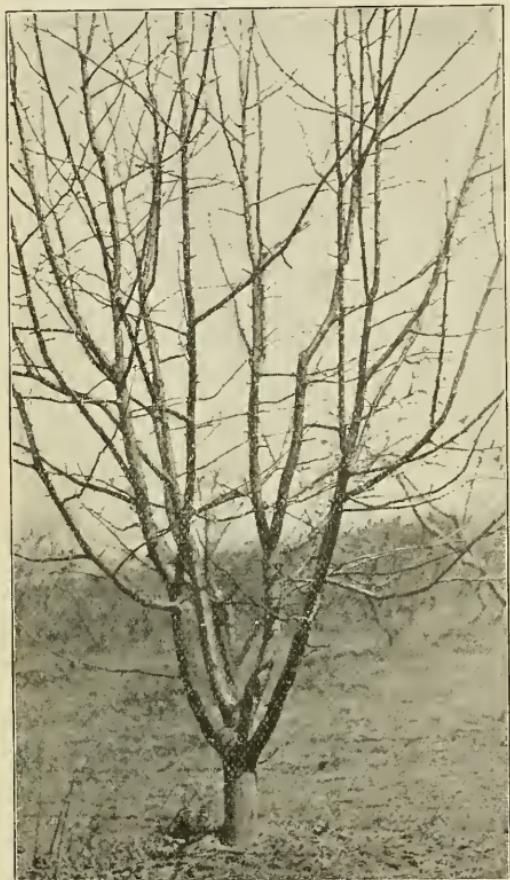


Fig. 8.—A well pruned open head tree.

will become crowded and he will be compelled to remove large limbs instead of the twigs he should have cut away in the first place. Moreover these limbs, because of their crowded condition, will have grown long and spindling and have become unable to support satisfactorily the future crops they are to bear.

The three or four primary branches selected for the first scaffold should be headed back to 14 or 16 inches in length,

Pruning at the End of the First Year. If the tree has made a strong growth, several good branches will have been produced. Select three, or at the most four, of these which are well arranged about the tree and remove all others. It is a temptation to the beginner to leave five, six, or even more main branches since they give the tree a pleasing appearance at this time. Sadly will he regret the act if he yields to this temptation. In a few years these branches

since the secondary limbs, which will grow from near the ends of these, should be not less than about a foot from the trunk. The central stem or trunk is almost invariably extended upward by the growth of the uppermost bud. This leader should be cut back to 16 or 18 inches in length (Fig. 11). If the growth of the tree has been weak, both the scaffold branches and leader should be cut back to mere stubs and another year taken to extend them to sturdy branches of proper length. If an open head tree is to be grown, it should be started as previously outlined except that the central leader should be removed. In starting either tree, and especially the open head one, branches should be selected, if possible, which are spaced several inches apart along the trunk in order to avoid the weak crotches which result where several branches arise at the same point.

Second Year Pruning. From near the end of each of the first or primary branches several secondary branches will grow during the second summer. Also, the uppermost bud of the leader will usually grow nearly straight upward and extend the leader, while a few side

branches will probably be produced (Fig. 12). The ideal method of procedure at this time is to select two secondary branches on each of the primary branches and remove all others. These branches may then be headed back but not as severely as were those of the first year. A length of 18 to 20 inches would not be excessive for these branches but all depends on their stockiness. Long, willowy branches must be headed back more severely than sturdier ones. The ideal branching habit of two secondary limbs from each primary limb can not always be maintained, because in some cases three secondary branches may be required to fill a certain space and in other cases it may be necessary to continue the primary limb without any side branches. The central leader

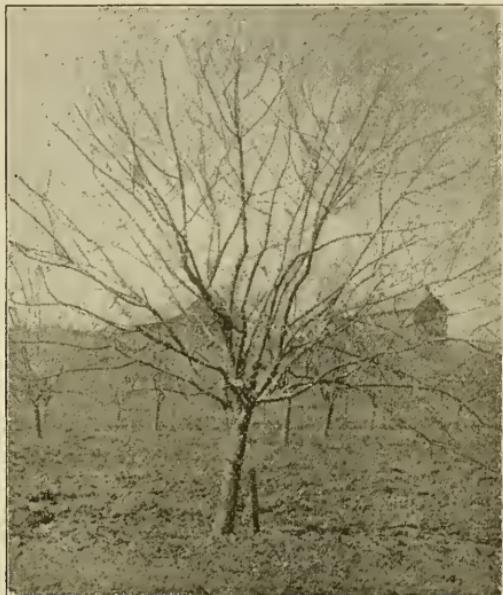


Fig. 9.—Natural form tree, too many limbs, no ideal in mind. Not recommended.

should be continued by a suitable branch which may be cut back to 16 or 18 inches. Thus, at this time the leader extends from $2\frac{1}{2}$ to 3 feet above the first scaffold. Any good sized branches formed on the leader should be removed, but all short spurs should be left on as they may bear the first fruits of the tree. By omitting the directions concerning the leader, the preceding directions will apply also to the open head tree.

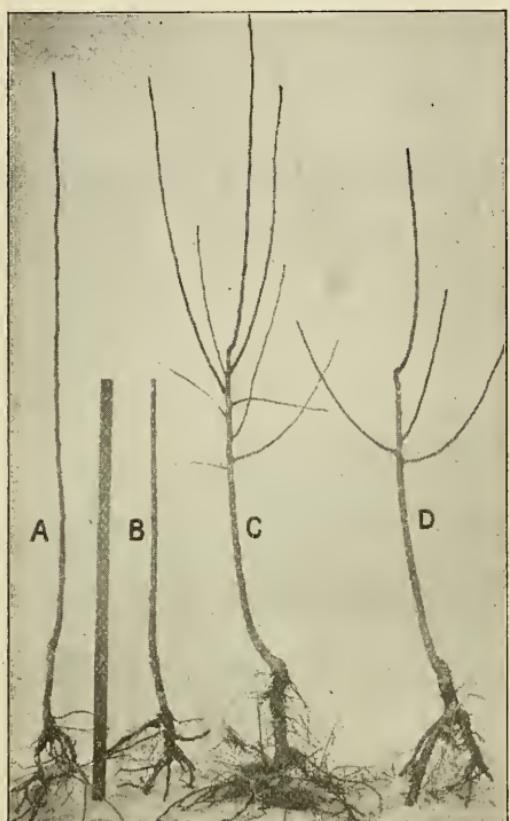


Fig. 10.—Nursery Trees. (A) Unpruned one-year-old apple tree. (B) One-year-old apple tree pruned as at planting time. (C) Unpruned two-year-old apple tree. (D) Two-year-old apple tree properly pruned with central leader as at planting time.

Third Year Pruning. The first and second year's pruning were necessarily heavy in order to secure a proper branching habit, but the third year the treatment should be less severe since continued heavy pruning, as shown later, results in a marked dwarfing of the tree. At this time one should again try to select two branches from each of the secondary branches and remove all others of any considerable size. It rarely happens that this ideal branching habit can be carried out perfectly for three years, but it is well to have an ideal. These tertiary branches should be headed back only slightly. An open head tree, the third year, should be

pruned just as outlined. In the central leader tree the time has now come to start the second story or scaffold. The leader at the last pruning was nearly three feet in length. From near its top a number of side branches will have been produced and from these three or four should be selected for the upper scaffold. This scaffold should be treated in every respect like the first one formed two years earlier. Care should be taken to prevent the scaffold's being formed lower

than 30 inches above the first story, since growing the two nearer together will result in crowding in later years. As a rule, the upward growth of the leader should be discontinued at this time and thus the upper scaffold is practically an open head tree (Fig. 13). If the tree is headed very low and the distance between scaffolds happens to be a little short, there is no objection to continuing the leader and eventually building a third story to the tree. This plan is not generally recommended, however, for it will usually make the tree too high.

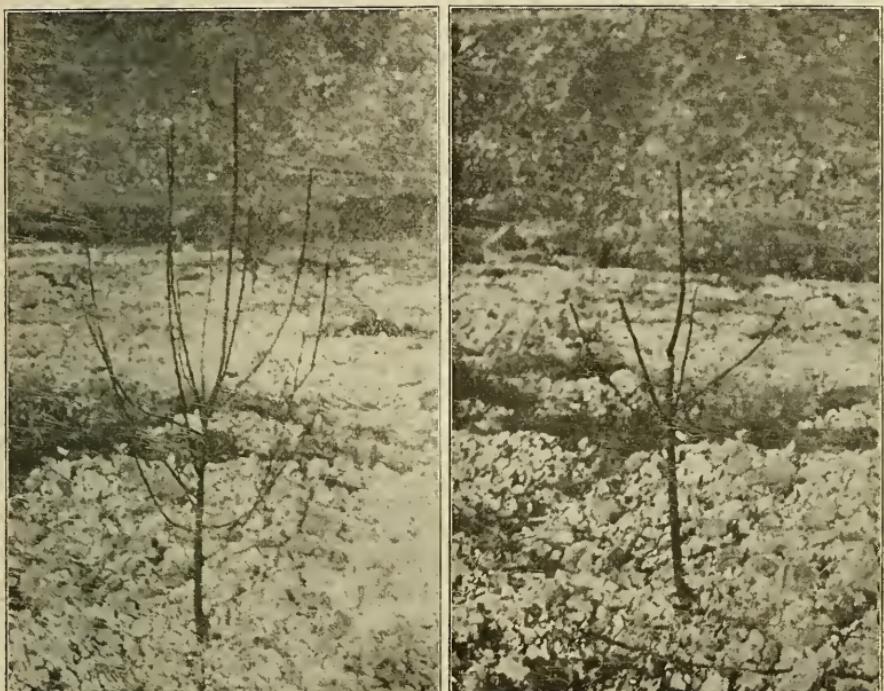


Fig. 11.—Before and after pruning at the close of the first season's growth.

It sometimes happens that, at the second year's pruning, satisfactory branches may be found with which to start the second story. Under no circumstances should one yield to the temptation and allow them to remain and start the upper scaffold a year early. The tendency of all plants is to make their greatest growth toward their extremities, and an upper scaffold started too soon would overgrow and in time completely overwhelm the first (Fig. 14). The branches of the lower scaffold should reach nearly as high as those of the upper scaffold when the latter is formed.

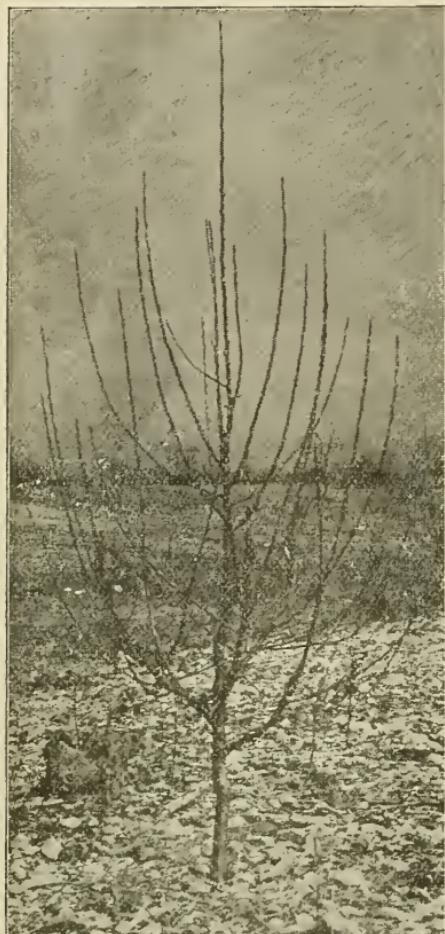


Fig. 12.—Unpruned apple tree at the close of the second season's growth.

X Early Vigor of Tree as Affected by Pruning. It has long been the popular belief that heavy pruning of trees in the dormant season insures a correspondingly heavy growth during the following summer. Some recent experiments by the West Virginia Agricultural Experiment Station reported more fully in Bulletin 158 (Technical) throw some light on this phase of the subject. In several orchards of different ages, pruning plots were laid off in such a way that the effects of varying degrees of dormant and summer pruning might be studied. It was found, first of all, that trees given heavy dormant pruning the first two or three years of their life responded with greater actual growth than did trees pruned lightly. After the third year the results were reversed and heavy annual dormant pruning produced a dwarfing effect, whereas the lightly pruned trees grew vigorously. This effect is well shown in Table I.

TABLE I.—Average Total Length of Longitudinal Growth Annually Produced per Tree on Trees Planted in 1911. (Stark Variety).

SEASON OF GROWTH	Heavy Pruning		Light Pruning	
	Total Length of Growth in Feet	Total Length of Growth in Feet	Gain Over Heavy Pruning in Feet	
1911	4.41	5.58	.....	.....
1912	16.25	15.51	.....	-.74
1913	41.53	34.33	.....	-7.20
1914	84.08	99.39	.....	+15.31
1915	161.74	224.89	.....	+63.15

In addition to measuring the length of growth for one variety, the increase in diameter of trunk was secured for a large number of trees of four varieties: Stark, Stayman Winesap, Rome, and Gravenstein. Here again it was found that heavy pruning at first caused increased growth but, beginning with the third year, the lightly pruned trees began to grow more vigorously and by the time the trees attained bearing age had completely outstripped the others, as indicated in the accompanying table and Figure 15. The lightly pruned trees also exceeded the heavily pruned ones at the end of five years in spread of branch and height of top.

It should be stated that, although light pruning was followed by greatest total growth during the five-year period, heavy pruning during the same period was invariably followed by a production of terminal shoots longer and heavier than those produced by light



Fig. 13.—A well formed two scaffold tree photographed during its fourth season's growth. Notice distance between heads, stocky trunk, leader.

TABLE II.—Effect of Varying Degrees of Dormant Pruning upon Size of Five-Year-Old Trees and Rate of Growth for First Five Years (Berkeley Springs Orchard).

Type of Pruning	Number of Trees	Diameter of Trunk in Inches					Height of Tree in Feet in 1915	Width of Tree in Feet in 1915
		1911	1912	1913	1914	1915		
Heavy	73	.34	.73	1.12	1.46	1.95	7.45	4.68
Moderate ..	34	.33	.73	1.11	1.49	2.02	7.74	4.93
Light	44	.33	.72	1.12	1.59	2.26	9.40	5.11

pruning. This means that the growth energy of the heavily pruned trees was concentrated in a comparatively few branches which grew with corresponding vigor. This growth is a desirable thing during the first two or three years when

a strong framework is being constructed, and is strictly in accord with our recommendations for first and second year pruning. The lightly pruned trees produced a greater number of branches, but these branches were moderate in size and to the casual observer would appear less vigorous than those on the heavily pruned trees. This optical illusion is probably responsible for the popular belief that heavy pruning is always followed by a greatly increased growth.

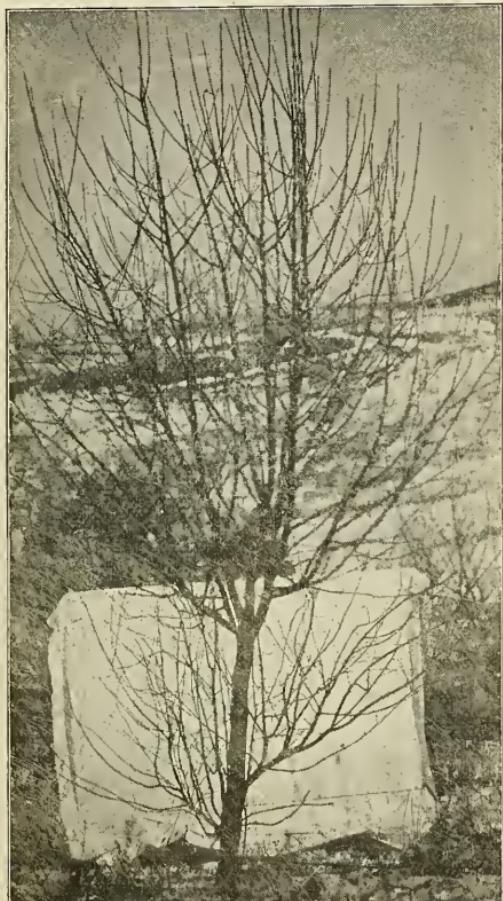


Fig. 14.—An upper scaffold started too soon completely overgrows the lower scaffold.

superfluous branches of the lower head with no heading back except to restrain an unruly or rampant growth. The upper head or scaffold should be headed back a year or two longer in the same manner as described on pages 10 to 12 for the lower scaffold. It will be seen that this means a gradual lightening up of all pruning so that following the fifth year no heading back will be required, even in the second scaffold. This method creates a condition favorable for fruit bud formation since it is a generally accepted fact that light pruning encourages early bearing, while heavy pruning delays fruit-

Pruning for Fruit Production. After the third year, the pruning should gradually change in character. By this time the framework of the tree will have become fairly well established and, from the standpoint of training, the grower needs to remove only the super-

ing. This fact is strikingly demonstrated in Table III where data collected from four orchards are shown. The experiments in the Berkeley Springs and Sheets orchards were

TABLE III.—Influence of Pruning Upon Early Bearing.
Berkeley Springs Orchard—Planted in 1911.

Variety	Type of Pruning	Bloom Clusters per Tree, 1914	Percent Bloom per Tree, 1915	ent Fruit Buds per Tree, 1916
Stayman Winesap	Heavy	0	1	50.4
Stayman Winesap	Moderate	.16	6.4	72.4
Stayman Winesap	Light	.05	13	86.3
Rome	Heavy	0	0	17
Rome	Moderate	1.6	9	66
Rome	Light	2.4	10	51
Gravenstein	Heavy	0	0	36
Gravenstein	Moderate	0	0	30
Gravenstein	Light	0	0	54
Stark	Heavy	0	0	34
Stark	Light	0	0	61

Sheets Orchard—Planted in 1910.

Type of Pruning	Fruit* per Tree, 1914	Fruits per Tree, 1915	Percent Fruit Buds per Tree, 1916
Heavy	0.0	0.7	3.7
Moderate	0.2	12.2	20.0
Light	2.0	24.0	38.0

Lupton Orchard—Planted in 1907.

Type of Pruning	Yield in Lbs. per Tree, 1914	Yield in Lbs. per Tree, 1915	Ave. Yield in Lbs. for Both Years
Heavy	3.51	4.21	3.86
Moderate	3.88	7.51	5.7
Light	2.85	14.68	8.76

Grimes Golden Orchard—Planted in 1906.

Heavy	141.6	64.34	102.97
Moderate	112.8	150.58	131.69
Light	146.4	150.55	148.48

started when the trees were planted and those in the Lupton and Grimes Golden orchards when the trees were six and seven years old respectively. Only a few scattered fruits were produced in the latter two orchards the first year of the test, 1912, and the following year the crop was destroyed by a freeze so that only the crops in 1914 and 1915 were recorded.

The difference in favor of light pruning is more pronounced in the younger orchards than in those which had practically attained bearing age before the experiment began. This difference is probably due to the fact that light pruning

produced a greater relative gain in the actual size of the younger trees than was possible in the older group. From the time the first production begins the pruning should be light in character but should be performed each year. In a general way this pruning should consist of the removal of broken, dead, or badly-diseased branches; the thinning out of thick clusters of branches; the removal of cross branches; and the thinning of those which run parallel to each other and compete for the same space, air, and light. Varieties such as Stayman Winesap which are of free and open growth will



Fig. 15.—Showing the effect of heavy dormant pruning (on the left) and of light dormant pruning (on the right).

require very little annual pruning, while the Rome and others which produce a "bunchy" growth will require considerable attention. If a tree has been properly pruned from the start, it should seldom be necessary to remove large limbs after bearing has begun.

Pruning for Rejuvenation. In the case of orchards which have been neglected, the recommendations concerning heavy and light pruning are reversed. Not only is heavy pruning desirable in such cases, but it is usually absolutely necessary in order to put the tree into a condition favorable to fruit development. If the tree shows a fairly healthy condition with a small amount of dead wood, but is very brushy and thickly

TABLE IV.—Effect of Pruning Upon Yield in a Mature Orchard.

Variety	Heavy Pruning Yield in Bus.	Mod. Pruning Yield in Bus.	Light Pruning Yield in Bus.
Arkansas (Mammoth Black Twig)	9.65	8.2	7.89
York Imperial	14.02	11.94	9.15

branched, one should not do all the pruning necessary at once, but should thin the branches gradually for two or three years. If the pruning is all done at one time, a heavy and undesirable growth of water sprouts will follow. On the other hand, if the tree is weak and contains much dead wood, it would be best to give it a complete and heavy pruning at the start so as to stimulate an active growth of new wood (see cover page). Curiously enough a heavy pruning on such a tree usually stimulates fruit production as well as wood growth. This effect is well illustrated in Table IV which shows the results of heavy and light pruning in a mature orchard that was below normal in vigor at the beginning of the experiment but was not what is usually considered a neglected orchard.

Summer Pruning. Popular articles recommending summer pruning for apples on the theory that the checking of wood growth would be followed by a production of fruit buds have made frequent appearance in the agricultural press. Briefly stated, the theory looks all right but thus far it has apparently failed to work except in a few western states. Wood production and tree vigor are unquestionably reduced, especially on young trees, but fruit production fails to follow. In the accompanying tables the results from the West Virginia experiments bear out the preceding statement.

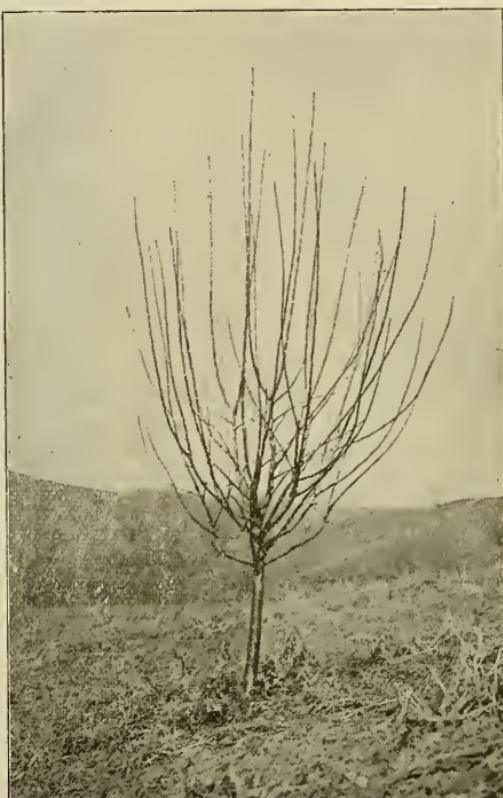


Fig. 16.—Too many main limbs to form the head. These should be thinned down to not more than five or six.

TABLE V.—Effect of Summer Pruning Upon Vigor and Fruitfulness.
Young Trees in Sheets Orchard—Planted in 1910.

	Fruits per Tree, 1914	Fruits per Tree, 1915	Percent Fruit Buds per Tree, 1916	Total Growth per Tree, 1915
Average heavy, moderate, and light dormant pruning.....	.7	12.3	20.6	197 ft.
Summer pruning	0	.3	10.4	120 ft.

Trees Just Coming Into Bearing.

Grimes Golden Orchard—Planted in 1906.

	Comparative Yields, 1914	Comparative Yields, 1915	Increase in Trunk Circumference, 1915
Dormant pruning	100	100	2.17 in.
Dormant and summer.....	36.8	69.5	2.00 in.
Summer pruning	12.3	53.9	2.01 in.

Lupton Orchard—Planted in 1907.

Dormant pruning	100	100
Dormant and summer.....	93.5	56.1
Summer pruning	75.2	51.5

As far as young trees are concerned, the data are very clear cut and indicate that in West Virginia, at least, summer pruning is a practice not to be recommended. Summer pruning actually delayed bearing in young trees and decreased the total yield of young bearing trees. In the mature bearing trees (not shown in Table V) the results were conflicting and the only conclusion that could be drawn was that with older trees summer pruning was less harmful than with younger trees. The authors feel that with any aged tree it is a doubtful practice and had better be left alone. This does not mean that one should not pinch back a stray shoot the first or second summer to aid in shaping the tree, but even this practice may be carried to excess.

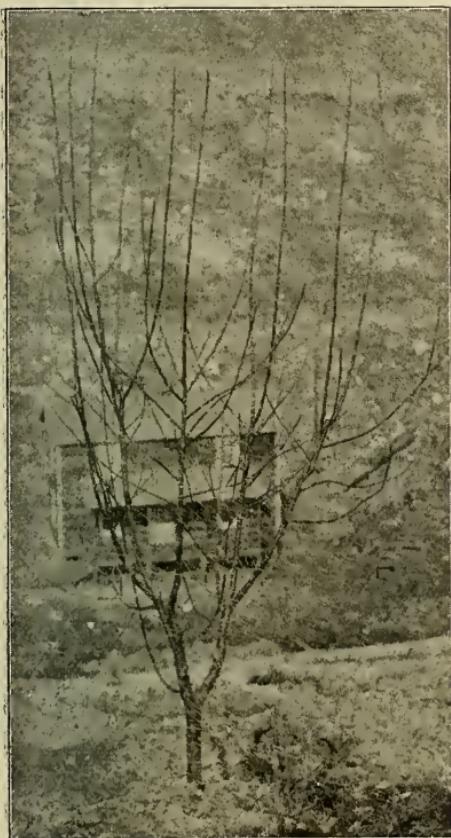
Ringing. The removal of a narrow strip of bark from the trunk of a tree just above the ground during the early part of June will almost invariably cause a heavy set of fruit buds for the following year. If care is taken not to injure the inner bark or cambium layer, the wound will heal readily and the tree will recover. In the West Virginia experiments this practice caused heavy crop production the following season, but the ringing and abnormal crop so impaired the vigor of the tree that three seasons were required to restore it to normal conditions. Ringing is to be recommended only for vigorous trees which show an apparent unwillingness to begin bearing.

Correcting Mistakes in Young Orchards. Members of the horticultural department of West Virginia University are frequently consulted as to the best pruning treatment for young orchards that have been neglected or badly treated. The problems presented are usually difficult and perhaps can never be very satisfactorily solved. Almost invariably the

majority of the trees will have too many main branches, from six to twelve being the usual number (Figures 9 and 16). To remedy this condition in young trees, the branches should be thinned down to the strongest four, five, or six. At best the result will be unsatisfactory as the branches were grown under crowded conditions and will be found lacking in stockiness. With older trees having the bearing wood crowded out toward the ends of the branches, fewer limbs can be removed. Another trouble often found is that, instead of too many branches, there are only two, thus making a forked tree which will be very liable to split when older. If the tree is not over five years of age, one branch of the fork should be removed entirely leaving the other to form a strong head (Fig. 17). If this is not

Fig. 17.—Forked tree. One main limb should be entirely removed.

done the two branches will force themselves apart by their own growth (Fig. 18). This will be followed by a breaking off of first one and then the other under weight of fruit or stress of storm (Fig. 19). If the tree is too old to warrant such treatment, the crotch may be strengthened by bolting the two forks together. **Do not try to make a radical change in the form of the tree.** If it has been started as an open head do not attempt to form a central leader; or if it is a fair central leader form, do not cut out the middle to make an open head. Although these alterations might be accomplished it



is hardly worth while, and the chances are at least ten to one that the result will be a weakened tree. It is far easier to grow the tree right from the beginning than to correct mistakes in early pruning.

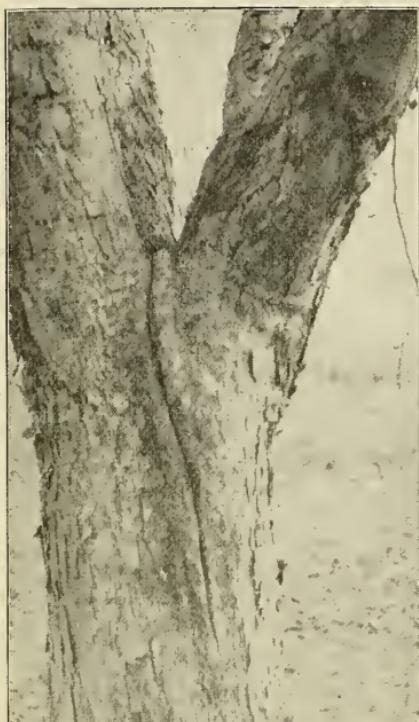


Fig. 18.—Crotch forced apart by growth of main limbs. One limb should have been removed when the tree was young.

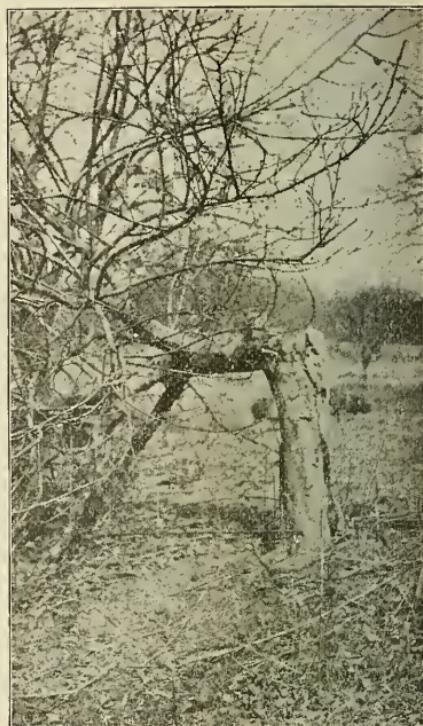


Fig. 19.—The usual result of a bad crotch. The next step following Fig. 18. Both pictures taken in the same orchard.

PRUNING THE PEACH.

Peach growing is becoming one of the important branches of the fruit industry in West Virginia. Probably few other states have larger orchards or denser plantings in their peach sections than has West Virginia. As a result of the extent of this industry and its increasing prominence, it is well to spend some time in studying the problems connected with peach pruning.

Height of Head. The advantages given in favor of low headed trees discussed under the pruning of the apple (page 4) are probably more important in the case of the

peach than the apple. All growers realize that after apple trees are twelve or fifteen years old, no matter how they may have been pruned, it will be necessary to use step ladders and straight sided ladders eighteen to twenty-four feet long in picking the crop. On the other hand, it is quite possible by the proper training of the young peach tree to keep practically all of the crop down where it can be picked from the ground during the entire life of the tree. Of course, low

heading alone will not accomplish this if proper training the first two or three years is not given. A low headed tree with its main scaffold limbs trimmed up so that the bearing wood starts at four or five feet from the ground will defeat the purpose of the low head. If a tree is trained properly, however, a low head aids greatly in keeping the crop close to the ground. Under West Virginia conditions, the yearling peach tree when planted should be cut off from twelve to fifteen inches high. This allows the main branches to come out along the upper portion of the trunk, and when the scaffold limbs are finally selected the next year, the lowest limbs will usually be from six to eight inches above the surface of the ground. Some

Fig. 20.—A low head does not insure a low tree. Note that lower branches from main limbs have been removed, thus forming a high tree.

growers cut off the yearling tree at six inches from the ground. This generally brings the main limbs out right at the surface of the ground and causes extra labor and annoyance at "worming" time. Borers in such cases not only get into the main trunk, but also get into the main branches as well.

Form of Tree. With peach trees the open head type of tree is to be preferred. This not only keeps the tree lower, but by keeping the center of the tree open, a supply of healthy, vigorous, bearing wood is maintained throughout the center of the tree and down the main branches.

Peach trees must be pruned somewhat heavier than apple trees and, as a result, denser tops are often formed. A judi-



cious thinning of branches is required in order to admit air and sunlight, to maintain a good supply of bearing wood throughout the center of the tree, and to insure well colored fruit.

Root Pruning at Planting Time. In all cases, regardless of the size and grade of the tree planted, the roots should be pruned somewhat before planting, as suggested on page 8, in the discussion of apple pruning. First, all broken and injured roots should either be removed close up to the tree or left from four to six inches long if the injured parts are beyond this distance. Second all roots which have grown twisted and become knotted together should be separated and some of them removed. The remaining roots should then be thinned out, and from three to five good healthy main roots left, together with some of the fibrous roots. Third, these three to five roots left should then be cut back to a length of from three to six or eight inches depending somewhat on the general size, health, and vigor of the tree and roots. In the cutting of the roots a sloping cut should be made so that when the tree is planted the whole cut surface will lie flat on the ground. The stub from the original seed-

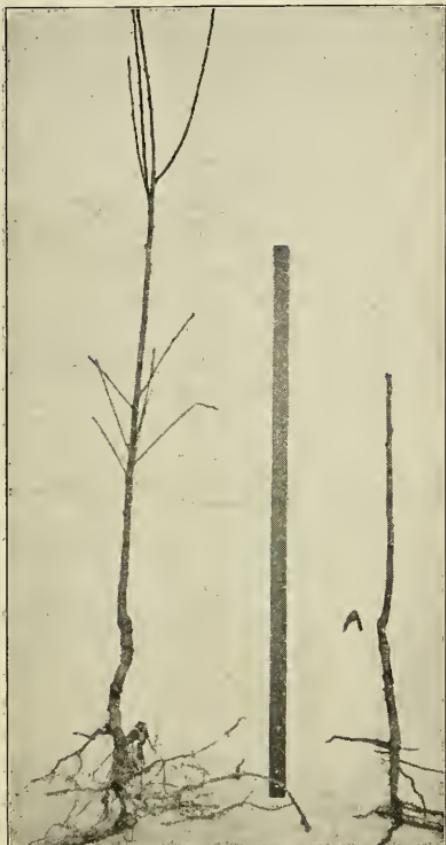


Fig. 21.—Medium sized peach tree before and after pruning. (A) indicates depth at which tree will be planted.

ling which is often found on peach trees should be cut off close up to the trunk so that it will heal over completely.

Top Pruning at Planting Time. After the tree is planted the top should then be pruned. It is understood, of course, that only one-year-old trees should be used in peach planting and, inasmuch as the best height of head for West Virginia is from twelve to fifteen inches, as discussed on page 23 the only pruning necessary at planting time consists of cutting

off the year-old switches at this height, provided they were medium sized trees, or trees ranging from five-eighths to three-fourths of an inch in diameter and being from three and one-half to five feet high (Fig. 21).

If trees are to be headed this low, it is desirable to plant a medium-sized grade, for in such cases there are many healthy buds left on the trees; or if these buds have grown into limbs in the nursery, they will generally not have been removed above the height desired for the head. The objection to extra large peach trees is that most of the lower buds have put out a growth in the nursery and these limbs were remov-



Fig. 22.—The result of poorly spaced limbs.

ed. If these limbs were cut off close to the trunk, it leaves practically no buds on the trees when they are headed from twelve to fifteen inches high. In such cases, it is then necessary for latent buds to force out near where the limbs were removed. Frequently, however, with such large trees having tough bark, a sprout is more liable to come up from the seedling root. If medium-sized trees or even the larger trees are obtained from which the lower limbs have not been removed and these limbs are healthy and vigorous, pruning should consist of picking out the three or four main limbs desired, cutting out all the others, and then heading back the limbs left. In such cases of low, well-branched trees, it would not be advisable to cut off all the limbs and leave only a switch twelve or fifteen inches high.

First Year Pruning. After the peach tree has made one year's growth, or during the spring following the spring in which the tree was planted, the first year's pruning must be performed. Probably a large number of branches will have grown from the switch left the year before. Three, well-placed, vigorous branches should be selected to form the framework or scaffold of the tree and all others should be removed. These three limbs should be spaced at least two or three inches apart on the trunk, since main limbs are more liable to break down in future years if they start out at the same place (Fig. 22). In some cases four main branches could be left if they were evenly and well placed about the trunk. More than four should never be left, and three are generally to be preferred. After the excess limbs are removed, the three that are left should be headed back. The severity of this heading back should depend a great deal on the nature of the growth and the stockiness of the limbs. This heavy cutting back is for the purpose of making the limbs shorter and therefore stockier and stronger, so that they may bear future loads of fruit without breaking. If the trees have made a short stocky growth, it will not be necessary to cut the main limbs back as severely as with trees that have made a long, slender growth. With this explanation in mind, anyone can see how difficult it is to set down any definite rules such as cutting off one-half, two-thirds, or three-fourths of the growth. If trees have made a short stocky growth as described, probably one-third to one-half of the growth would be enough to cut back, while in the other case cited, probably three-fourths or even more of the length should be removed. Bearing in mind, however, that a low tree is desirable in this state, the first main limbs should be cut back to one and one-half or two feet in length. In case one of the laterals is weaker and shorter than the others, it should be pruned rather lightly, while the other two should be more severely shortened back in order to balance the tree, and cause the weak limb to strengthen. In cutting back the limbs the cuts should be made obliquely just above an outside limb, in order to create a tendency for the tree to spread rather than to grow upright as would happen if the cut were made to an inside bud or limb (Fig. 23). If the lateral branches spring from too near the tips of the main limbs, these laterals should be ignored and the main limbs cut back to the proper lengths (Fig. 24). Any long and willowy lateral growths should be shortened back.

Sometimes a tree makes an uneven growth and produces only one or two limbs on one side of the tree, often near the ground. It will be well in such a case to remove all of the

limbs but one; cut off the original tree down to this one limb; then head back that limb to twelve or fifteen inches in height; and start a new head the next year.

Second Year Pruning. From each of the three main limbs left the year before, a large number of laterals will probably have been developed and a great many new growths will have filled up the center of the tree. The pruning this year should consist of selecting two or possibly three well-placed laterals on each of the main limbs and the removal of practically all



Fig. 23.—Peach tree before and after pruning after one year's growth. In cutting back the main limbs the cut should be made just above an outside bud or limb.

of the others. The two or three laterals chosen should be those which are low and spreading outward, in order to keep the tree low and open. These laterals should be cut back severely but not as much so as were the main limbs the year before. The character of the growth will again determine how much they should be cut back. If short and stocky, they should of course be cut lightly; but if long and slender, they should again be cut at least one-half of their

growth, as otherwise, if these limbs were left long, our purpose of obtaining a low headed tree would be thwarted. A general rule would be to cut these laterals back, leaving from one and one-half to two and one-half feet. These should be cut preferably just above an outward branching limb, but if there are no limbs within this length on the laterals, they should then be cut to an outside bud.

The center of the tree should then be thinned out somewhat and the remaining growth shortened back. It is unwise to remove all of this center growth as the bulk of the first

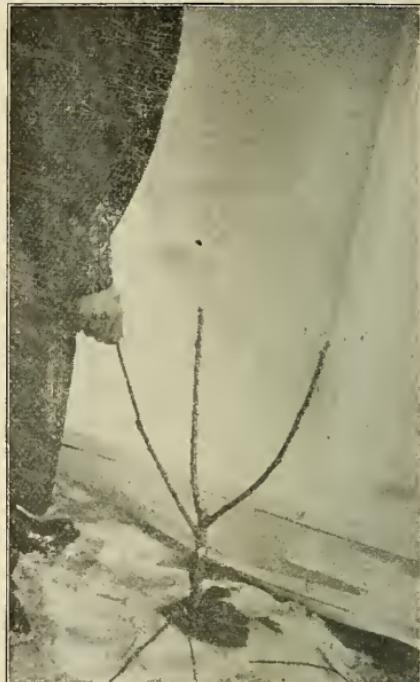


Fig. 24.—Peach tree before and after pruning at the end of one year's growth. If the lateral branches spring from too near the tips of the main limbs, these laterals should be ignored and the main limbs cut back to proper length.

crop of peaches is usually borne on these small twigs throughout the center and lower parts of the tree. In this year's pruning as in that of the preceding year, the main object is to form a low, open type of tree with stocky, well-placed limbs that will be able to bear future crops without breaking.

Third Year Pruning. Pruning the third year should be much along the same lines as that of the preceding two years, but the amount to be cut back should be decreased. It should be the aim again to select two or three sub-laterals from each

of the main laterals left the year before, in order to continue the building of the main framework of the tree. These should preferably extend away from the center of the tree and should be cut back about one-third of their growth. Limbs which cross and interfere with one another should be removed or shortened; other sub-laterals along the main laterals, left the year before, should be trained and pruned to fill up the vacant places; the top and center of the tree should be thinned out and cut back moderately. This year it will probably be necessary to remove entirely several small limbs along the main branches and laterals in order to avoid crowding. The removal of several twigs in the top of the tree will allow sunlight and air to get into the tree and will keep up a good supply of bearing wood for the next year's crop. As suggested under second year pruning, the small limbs throughout the lower and central parts of the tree should not all be removed, as these will bear the bulk of the first crop and will gradually thin themselves.

Summer Pruning the First Three Years. It will be noted that all of the pruning up to this time has been done during the dormant season; that is, in the spring just before growth started. Under certain conditions, it might pay the first three years to do in addition a slight amount of early summer pruning (from June 1st to 15th—when the new growth is from eight to eighteen inches long). In some cases where the trees are planted on strong soil and are making a very vigorous growth, it might be advisable to remove some of the excess growth in the center of the tree and to pinch back the main laterals, thus causing them to branch lower and sooner. By so doing the amount of dormant pruning will be reduced the next year, thus checking to some extent the rapid growth following such a heavy pruning and, in addition, a year's time may be saved in building the framework of the tree, if good healthy laterals form and develop on the shoots which were pinched back. In other cases, it might pay to remove some of the excess growth in the center of the tree and pinch back all laterals except the ones needed to form the framework of the tree. In this way, the energy of the tree will be thrown into these laterals, causing them to become exceptionally strong and vigorous. If for some reason one of the laterals makes a much longer growth than the others, thus throwing the tree out of shape, it might pay to pinch this one back, thus keeping the tree well shaped. This summer pruning, by checking the vigorous growth and perhaps saving a year in building the framework of the tree, is said by some growers to induce earlier and larger crops while the tree is young.

It should be remembered, however, that summer pruning is a devitalizing process, and that trees which are making only a moderate or weak growth should never be summer pruned. In fact until more definite information is acquired concerning the effects of summer pruning the peach under different conditions of growth, the practice is not to be generally recommended. It should never be performed by one who has not given the matter a good deal of study and who does not understand thoroughly the principles of plant growth and the



Fig. 25.—The main object has been to form a symmetrical tree low branched and low headed. By rather severe pruning the first three years this is attained.

character of growth which will result under his conditions of soil and climate.

Summary and Results of First Three Years' Pruning. During the first three years' pruning, it will be noted that the main object has been to form a strong, symmetrical tree, low branched and low headed (Fig. 25). It is possible that, by this moderately severe pruning during the first three years, bearing will be slightly delayed and the first crop will not be quite so large as it otherwise would have been if very light pruning, especially light heading back, had been practiced. On the other hand, in our large commercial orchards in which the bulk of the peaches are picked by women and children,

it can easily be seen that this slight advantage of a larger first crop will easily be offset by the ease and cheapness with which the future crops can be picked and handled. Being able to pick the crop from the ground with the labor of women and children and without the use of ladders is especially desirable, since most of the large orchards are planted on mountain sides where it is usually difficult to handle a ladder. It is also a fact that a high headed tree bearing a heavy load of fruit is more liable on our mountain sides to be blown over than a low headed one, especially if the roots and trunk have been injured somewhat by borers. High headed trees with long limbs, which have not been cut back somewhat, certainly split down by snow, sleet, and ice much easier than the lower, stockier branched trees.

Later Pruning of the Peach. Although occasionally good crops of peaches are secured the third year, still in most cases the first commercial crop is borne during the fourth year. Beginning with this year, the trees should bear regularly and as a result will make a much less vigorous annual growth. The severity of the pruning will necessarily lessen considerably. It is now time to lighten the pruning and encourage the trees to bear. Continued heavy pruning will only delay bearing. This same general law can also be applied to other fruits. The fruit of the peach is borne entirely on new wood and it should be the aim to prune only enough to keep up a supply of this wood. It will probably be necessary to thin out several small branches and twigs each year and to cut back some of the leaders and exceptionally strong growing shoots in order to keep those remaining healthy and vigorous. The cutting back of some of the smaller growth and terminals will not only help to thin the fruit, but will also keep up the supply of new wood.

The tops of the trees should be thinned out sufficiently to let in enough air and sunlight so that a healthy supply of bearing wood will be maintained and kept productive throughout the centers of the trees and down the main limbs. Long, bare branches entirely lacking in bearing wood should be avoided. It should always be the aim to keep the bearing surface low and not allow the fruit to be produced gradually higher and higher in the tree each year. This means that in some years the main laterals or leaders should be headed back somewhat severely, even into the two-year-old wood. The bearing wood, which is produced as a result along the main limbs and throughout the center and lower parts of the tree, should be retained.

While the terminal growths around the outside and top of the tree should generally be headed back from one-fourth to

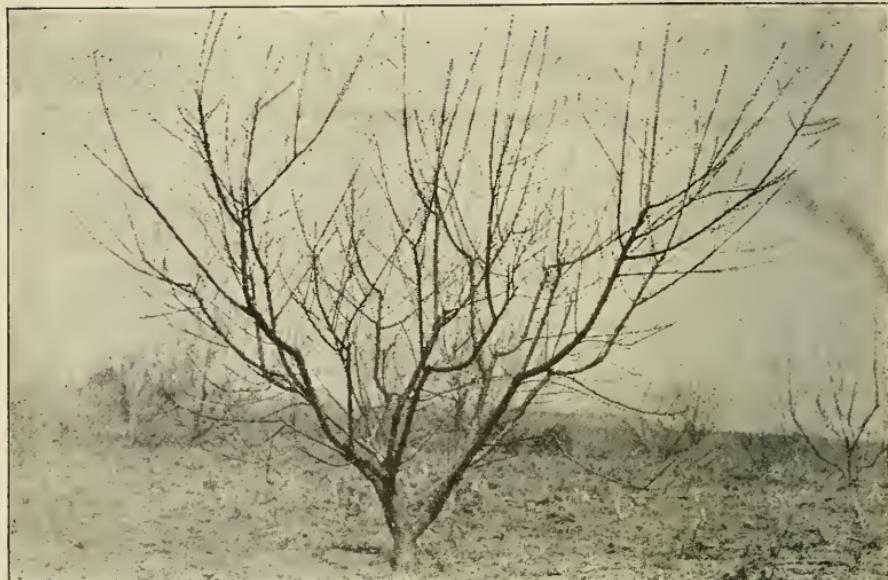


Fig. 26.—A well formed seven-year-old peach tree before pruning. Note that this tree is low branched, spreading, and low headed.



Fig. 27.—Same tree as in Fig. 26 after pruning. Note that heavy pruning has been discontinued at this age. Some twigs have been removed from the center of the tree and the central shoots from the main limbs have been removed. Uniform clipping of all terminal growth has not been performed.

one-half their length, yet it is not desirable to clip all growths evenly each year and leave the tree looking like a trimmed hedge. Some of the stronger leaders should be headed back and the general shape of the tree preserved, but it will not pay or be advisable to clip back all the smaller and weaker growths (Figures 26 and 27). Much more good would result from cutting out some of the smaller growths entirely, thus causing the remainder to be healthier and more vigorous.

Briefly then, with bearing trees, the aim of pruning should be to keep up a supply of bearing wood throughout the centers and lower parts of the trees as well as on the upper and outside portions. This means that the tops and centers must be kept thinned out; the main leaders should be kept shortened back; and, in addition to shortening some of the outside lateral growths, others should be removed entirely. The shearing process is neither necessary nor to be recommended.

Renewal of Bearing Wood in Old Trees.

It often happens that peach trees which have not been pruned back enough when young develop long weak and slender main branches or in some cases with trees which have been fairly well pruned the bearing wood gradually gets up beyond convenient reach (Fig. 28). When the trees are ten or twelve years old, the bearing wood not only is high, but begins to get scarce and lacks vigor. In such cases or in similar ones it often becomes necessary and advisable to lower the bearing surface of the tree or to "dehorn" it. If the trunk and main limbs are apparently healthy, this de-



Fig. 28.—This tree was properly cut back the first year, but the next two years the branches were not cut back. Note that the bearing wood is beyond reach. Compare with Fig. 25. Dehorning would be proper treatment.

horning process is advisable inasmuch as the trees can again be made profitable and several more crops can be secured from them. As a matter of fact, dehorning is often performed by many growers two or three times during a tree's life, and good crops are secured for twenty or thirty years.

In general, there are two ways of lowering the bearing surface of such trees. One method, which is probably the better, is to lower the head gradually. The



Fig. 29.—Dehorned peach tree which had become too high. Before dehorning this tree resembled the one in Fig. 28. Note the resulting growth of bearing wood from the stubs left. It will again be possible to pick several crops from the ground.

year, the growths on the limb last cut off should be cut back and thinned out and the growths on the other stubs should be pruned lightly as they will now be bearing. It can be seen that by this method the crop will never be entirely lost, but that peaches will be borne yearly while the tree is being lowered and invigorated. From this new top several good crops should be obtained before the usefulness of the tree is over or before dehorning again takes place.

first year one of the main limbs should be cut back quite severely leaving from one and one-half to three feet of the limb, together with some side branches which likewise have been heavily cut back. The other two limbs are headed back slightly, but not enough to destroy their crop during that year. The next year, the growth, which will have come out from the stubs the year before, should be thinned out and headed back severely and one of the other remaining main limbs should be cut off in the same manner as was the first the spring before. The third year, the growth on the two stubs should be pruned back moderately and the third and last main limb cut back. The fourth

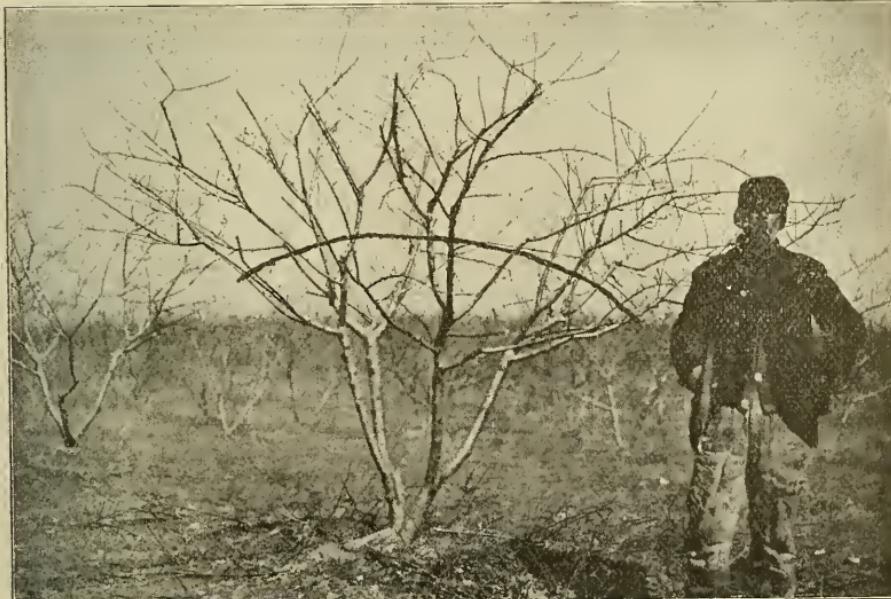
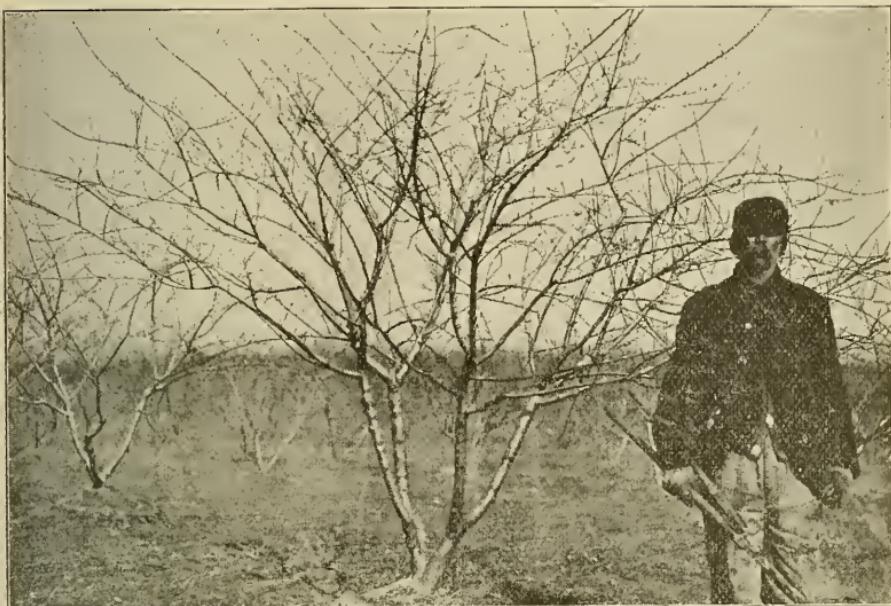


Fig. 30.—An old peach tree before and after severe pruning. By this type of pruning, enough bearing wood has been left to insure a fair crop of fruit, while new bearing wood will be forced out through the central and lower parts of the tree. Had this tree been frozen and the prospects of a crop destroyed, it should have been cut back as shown by the line drawn through the tree.

The other method of lowering the top is to cut back all the main branches the same year. In such a case, all limbs are cut back to stubs two to three feet or even less in length. It is well to leave a few sprouts on these limbs, if there are any, to start the growth and shade the limbs the next spring. By this method at least one whole crop is lost. New tops will form, however, the next year and if not pruned too heavily will bear the following year (Fig. 29). Weak trees should not be dehorned as severely as stronger ones, as in such cases they do not have strength enough to form even, strong tops and sometimes die outright. Some growers in renewing their trees cut back all of the tops only moderately and leave enough fruiting wood to insure a fair crop of fruit the same year (Fig. 30). In such cases the new growths which put out along the main limbs are carefully preserved and shortened back. In this way the bearing surface is materially lowered and good fruit is produced along the main branches where fruit had long since ceased to be borne.

Renewal of Bearing Wood in Frozen Trees. It sometimes happens that all of the buds, and in some cases the wood also, is frozen on peach trees during an unusually severe winter. This condition can easily be recognized if the centers of the fruit buds and the centers of the limbs have become brown to black in color. In the case of young trees up to four or five years of age, all of the bearing wood should be removed in the spring, leaving only the stubs of the main limbs from four to eighteen inches long, depending on the age of the trees. Yearling trees should be cut back to short stubs.

Bearing peach trees eight to ten years old should be dehorned but it has not been found advisable to dehorn them as severely as the younger bearing and non-bearing trees. Such older trees should be cut back into the four-year-old or five-year-old wood, thus leaving branched stubs from two and one-half to three feet long. Old trees when frozen make a more satisfactory recovery if the dehorning is moderate rather than heavy or light (Fig. 30).

PRUNING THE CHERRY.

In general, it is best when planting cherries to get good one-year-old trees. With such trees the heads can be started at a height that suits the preference of each individual grower. When extra large two-year-old trees are obtained, the heads have generally been formed by the nurseryman and in some cases they are either too high or too low to suit the grower.

After the trees are planted, they should be headed back to a height of from eighteen inches to two feet. After one season's growth, the branches which have come out from the trunk should be thinned and cut back about one-half their growth. With sour cherries, more main branches can be left at the head than with sweet ones. As many as five or six well-placed and evenly-distributed branches may be safely left with the sour cherry, while four vigorous main branches are generally enough to leave in the case of the sweet cherry.

Some growers in certain sections prefer the open head or vase form of tree for both kinds of cherries. In another cherry region the growers all use the central leader type, claiming that it makes a stronger tree. The sweet cherry naturally forms a central leader, while the open head is naturally formed by the sour cherry. In West Virginia, where cherry growing is not important, except as a home enterprise, the question of type of tree is of little consequence as either, when properly handled, will probably be satisfactory. Generally, the central leader type of tree, especially with the sweet cherry, is to be preferred. This leader should be proportionally shortened at the same time that the main limbs are cut back. The second and third years, the trees should be thinned out somewhat; the main framework should be continued by vigorous outward branching laterals; and these laterals should be headed back moderately. After the third year very little pruning should be given the cherry. Only crossing and interfering limbs should be removed; the center should be opened up somewhat to keep up a healthy supply of fruit spurs along the main limbs; and the central leader or main limbs should be topped back occasionally to keep the trees from becoming too high.

PRUNING THE PLUM.

As with the cherry, plum trees should be headed at from eighteen to twenty-four inches high. Three or four, well-placed, vigorous limbs should be selected to form the main framework of the tree and these should be headed back from one-half to three-fourths of their length, depending upon the vigor of their growth. The Japanese species of plums, such as Abundance, Burbank, and Red June, which generally make either a sprawling or vase-formed type of growth, are generally pruned with open heads, as are also those varieties in the American species, such as De Sota, Stoddard, and Oren. These last named varieties are inclined to grow bush-

like with long slender branches which are often thorny. Such trees must be opened up and thinned out well to allow ease of picking. The *Domestica* species of plums, such as the Lombard, Bradshaw, Reine Claude (Green Gage), and Pond (Seedling) which have an upright growth, are generally pruned with a central leader.

The second and third year's pruning should consist in all cases of thinning out the lateral and central growths somewhat; selecting well-placed and outward-branching limbs to



Fig. 31.—Bearing plum tree before and after pruning.

form the framework of the tree; and a moderate heading back of such limbs. If the central leader is used, it should be kept headed back in proportion to the main branches.

Later pruning of the plum should be rather light. Only crossing and interfering limbs should be removed and the general shape of the tree should be preserved (Fig. 31). The Japanese plums which bear much of their fruit on the preceding season's growth should be headed back moderately, especially those branches which are growing too rapidly and are injuring the shape of the tree. The American varieties especially should be thinned out and opened up for ease in

picking and in order to keep up a healthy supply of good fruit spurs throughout their centers. The Domesticas or upright growing trees should be thinned out lightly and headed back with discretion, as such trees grow thicker and higher with too much heading back. It is better, in such cases, to check growth somewhat by cutting down on the food supply rather than by pruning.

PRUNING THE PEAR.

In general, the amount and severity of pruning of the pear should be practically the same as that of the apple. If a yearling tree is planted, it should be cut back twenty-four inches from the ground; and if a two-year-old tree is used, limbs ranging from eighteen inches to two feet from the ground should be selected for the head.

Both the open head and the central leader type of tree are used in the case of pears. Some growers prefer an open head tree, claiming that fire blight can be more easily controlled with such a tree and that the head can be kept open easier and the height of the tree controlled. On the other hand, other growers claim that a stronger tree is produced by the central leader type, and that a larger tree with more bearing surface results from this method of pruning. Either method will probably prove satisfactory with the pear, but other things being equal, the central leader type is preferred.

The first two or three years' pruning should be as recommended for the apple; that is, three or four vigorous and well distributed limbs should be selected to form the main framework of the tree. These, together with the central leader, should be cut back somewhat severely the first year. Other limbs should be removed. The second and third years, the framework of the tree should be developed; unnecessary limbs should be removed; and the central leader should be continued to form a second scaffold. After the third year, pruning should be light. Only cross limbs and those which interfere should be removed, and only those that interfere with the symmetry of the tree should be cut back. The central leader should be kept in check or entirely removed after the second scaffold is formed in order to keep the tree low. During all of the formative period of the pear, cuts should be made to outside limbs and buds in order to open up and spread the tree as much as possible. These points should also be kept in mind during later pruning, as most of the common varieties of pears tend to grow straight up and form a narrow high tree.

PRUNING THE QUINCE.

The quince, being naturally a low, bushy form of tree, will never need very severe pruning. The tree should be headed back enough when young so that the main limbs will come out from four to eight inches above the ground. The first two or three years, a strong, well-branched framework should be sought, and consequently the limbs selected for the framework should be pruned back moderately, while all others that are too thick or that interfere with one another should be removed.

Future pruning should consist of cutting out cross and interfering branches, all dead wood, and the occasional topping back of some limbs in order to retain the symmetry of the tree. If the trees are making a fair growth each year, no heading back will be required except an occasional light thinning of some of the new growths; but in case of weak growth it will probably pay to head back the main branches somewhat to insure a fair amount of bearing wood. It should be remembered that the fruit of the quince is borne on new shoots the same spring that these shoots grow from the one-year-old wood. It is therefore necessary to prune just enough to keep up this supply of new and bearing wood.

